SMART IOT BASED
FISHERMAN BORDER CROSSING ALERT SYSTEM

MINI PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project **"SMART IOT BASED FISHERMAN BORDER CROSSING ALERT SYSTEM"** is the bonafide work of "**GIRIJA S P 230701092 , MANASA 230701172 and VARSHA 230701370"** who carried out the project work under my supervision.

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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LIST OF ABBREVIATION

ABBREVIATION	ACRONYM
IOT	Internet of Things
HTTP	HyperText Transfer Protocol
TEMP	Temperature
DHT	Digital Humidity and Temperature
API	Application Program Interface

ABSTRACT

This project presents the design and implementation of a Smart IoT-Based Fisherman Border Crossing Alert System.The increasing incidents of fishermen inadvertently crossing international maritime boundaries have led to severe consequences, including arrests and legal actions. This project presents the design and implementation of an IoT-Based Fisherman Border Alert System aimed at preventing such occurrences. The system utilizes GPS technology to continuously monitor the real-time location of fishing vessels. When a vessel approaches the predefined maritime boundary, the system triggers audio and visual alerts, warning the fishermen to change course and avoid crossing into foreign waters.The core components of the system include a GPS module for location tracking, a microcontroller (such as Arduino Uno) for processing, and alerting devices like buzzers and LEDs. The system is designed to be cost-effective, durable, and user-friendly, ensuring accessibility for fishermen in remote coastal areas. By providing timely alerts, the system not only safeguards the fishermen from potential legal issues but also contributes to national security by preventing unauthorized border crossings.

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

Fishing is a primary livelihood for many coastal communities, especially in regions like Tamil Nadu, India. Fishermen often venture into the sea without clear knowledge of maritime boundaries, leading to inadvertent crossings into neighboring countries' waters. Such incidents have resulted in arrests, confiscation of boats, and even loss of lives, causing distress to fishermen and their families.The absence of visible demarcations at sea and limited access to advanced navigation tools exacerbate this issue. Traditional methods lack real-time monitoring and alert mechanisms, making it challenging for fishermen to stay within safe zones. There's a pressing need for a solution that provides real-time location tracking and timely alerts to prevent unintentional border crossings.This project proposes an IoT-based system integrating GPS technology to monitor the real-time location of fishing vessels. When a vessel approaches predefined maritime boundaries, the system triggers audio and visual alerts, warning fishermen to change course. The system is designed to be cost-effective, user-friendly, and durable, ensuring accessibility for fishermen in remote coastal areas.By implementing this system, we aim to enhance the safety of fishermen, prevent legal complications arising from border violations, and contribute to the overall well-being of coastal communities.

1.2 SCOPE OF THE WORK

This system is designed to ensure the safety of fishermen operating near maritime borders by providing distance-based alerts. The system can also be adapted for industrial safety, obstacle detection in robotics, and other proximity-based alert applications.

1.3 PROBLEM STATEMENT

Fishermen operating near international maritime boundaries often lack awareness of their proximity to these borders. This ignorance can lead to inadvertent crossings, resulting in arrests, confiscation of fishing equipment, and even loss of life. The absence of visible markers at sea and limited access to advanced navigation tools exacerbate this issue, leaving fishermen vulnerable to legal and physical threats. There is a pressing need for a real-time alert system to enhance their safety and prevent such incidents.

1.4 AIM AND OBJECTIVES OF THE PROJECT

This project aims to develop an IoT-based Fisherman Border Alert System that utilizes GPS technology to monitor the real-time location of fishing vessels. The system is designed to provide timely alerts to fishermen when they approach predefined international maritime boundaries, thereby preventing inadvertent border crossings and enhancing their safety. Key objectives include implementing real-time location tracking, defining maritime boundary coordinates within the system, developing an alert mechanism that activates audio and visual signals upon nearing the boundary, integrating communication modules for data transmission, designing a user-friendly interface to display location information, ensuring system integration for reliable operation under maritime conditions, and conducting field tests to validate the system's effectiveness in real-world scenarios.

CHAPTER 2

SYSTEM SPECIFICATIONS

2.1 IOT DEVICES

1. ESP8266-12E NODEMCU with Wi-Fi Module
2. DHT11 Sensor
3. Relay Module
4. DC Fan
5. AC Motor
6. Led Light

2.2 SYSTEM HARDWARE SPECIFICATIONS

PROCESSOR	Intel i3 11^{th} Gen
MEMORY SIZE	8 GB (Minimum)
HDD	40 GB (Minimum)

2.3 SOFTWARE SPECIFICATIONS

Operating System	Windows 11
XBrowser	Google Chrome
IDE	Arduino

CHAPTER 3
SYSTEM DESIGN

3.1 ARCHITECTURE DIAGRAM

An architecture diagram is a graphical representation of a set of concepts, that are part of an architecture, including their principles, elements and components

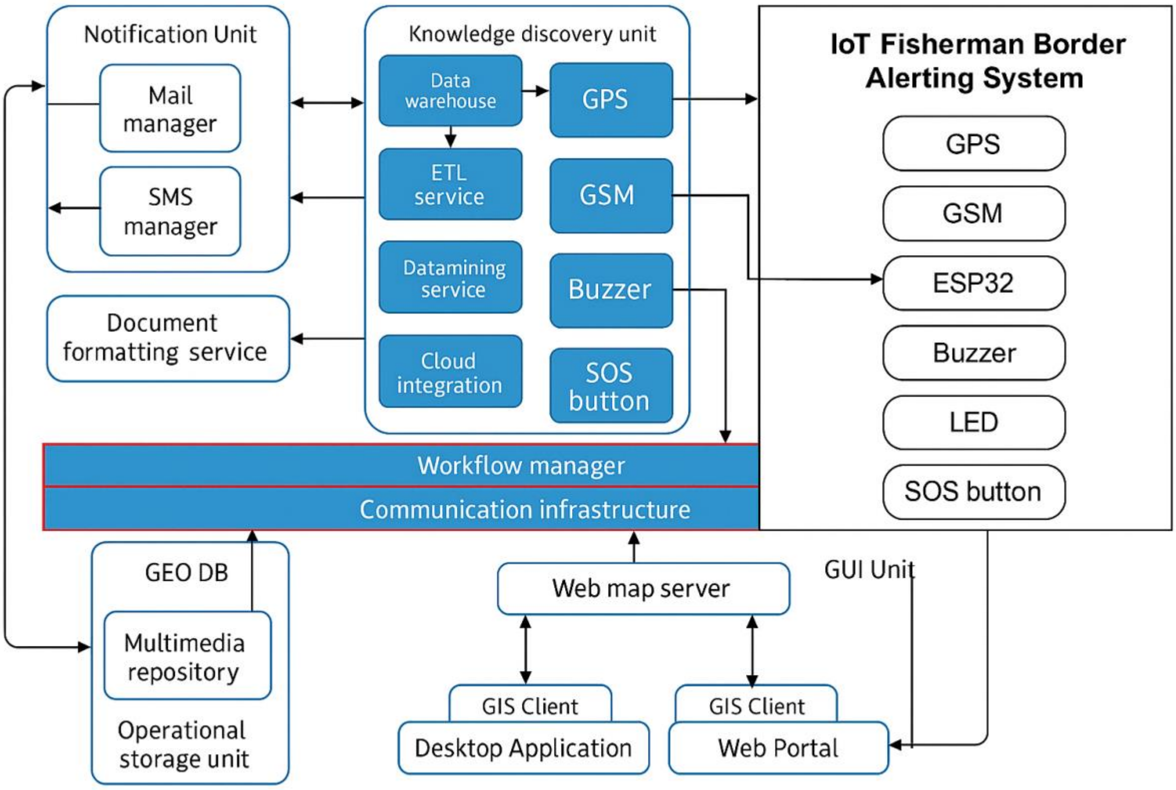


Figure 3.1 Architecture Diagram

From the above Figure 3.1, the architecture of the system is well understood.

3.2 USE CASE DIAGRAM

A use case is a list of actions or event steps typically defining the interactions between a role (known in the Unified Modelling Language as an actor) and a system to achieve a goal. The actor can be a human or other external system.

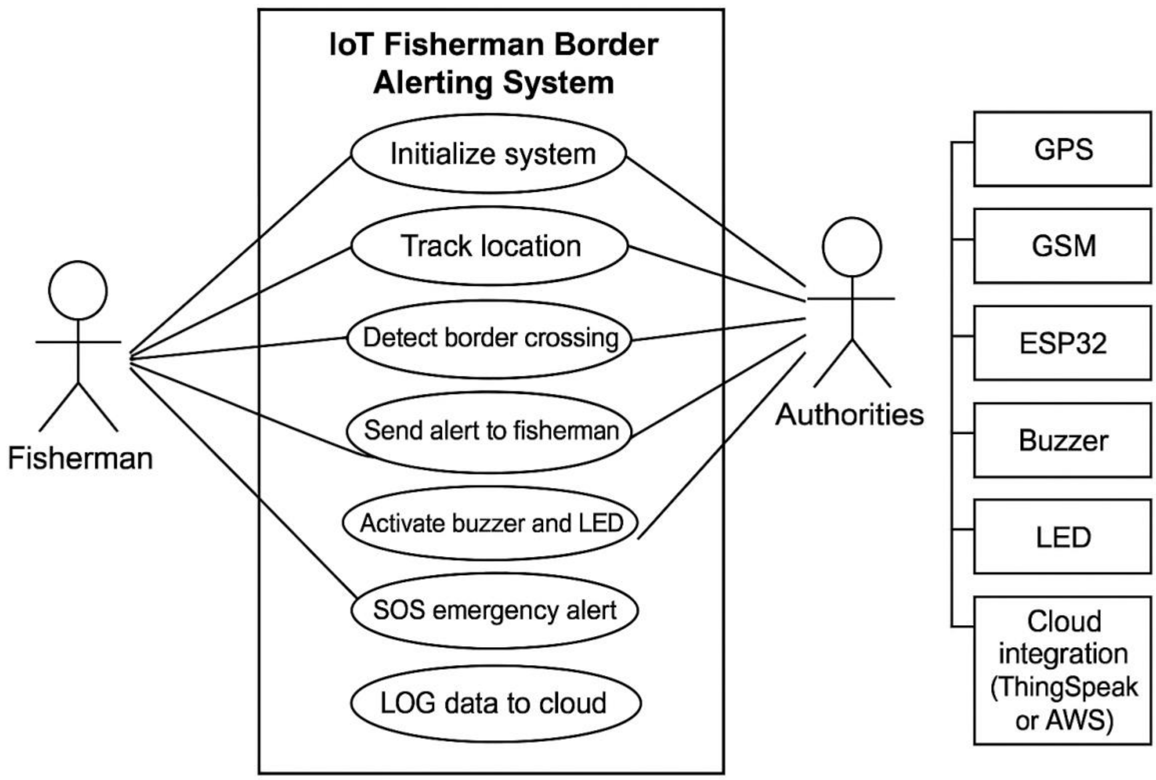


Figure 3.2 Use case diagram

From the above figure 3.2, the interactions between a role in the system is shown

3.3 ACTIVITY DIAGRAM

An activity in Unified Modelling Language (UML) is a major task that must take place in order to fulfill an operation contract. Activities can be represented inactivity diagrams. An activity can represent: The invocation of an operation. A step in a business process.

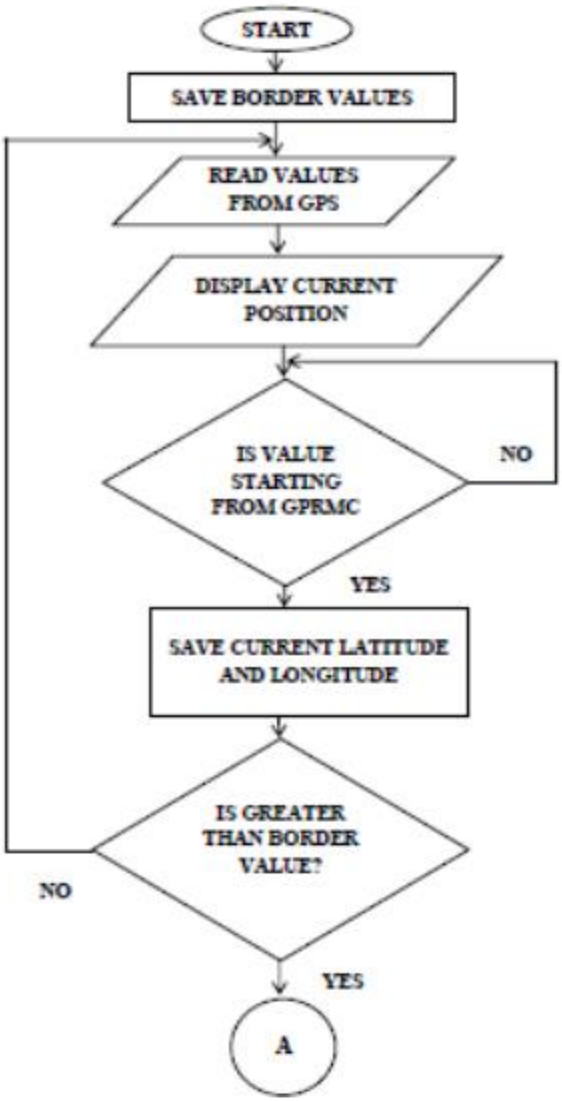


Figure 3.3 Activity Diagram

From the above figure 3.3, the activities of the system are shown

3.4 CLASS DIAGRAM

A class diagram is an illustration of the relationships and source code dependencies among classes in the Unified Modelling Language (UML). In this context, a class defines the methods and variables in an object, which is a specific entity in a program or the unit of code representing that entity.

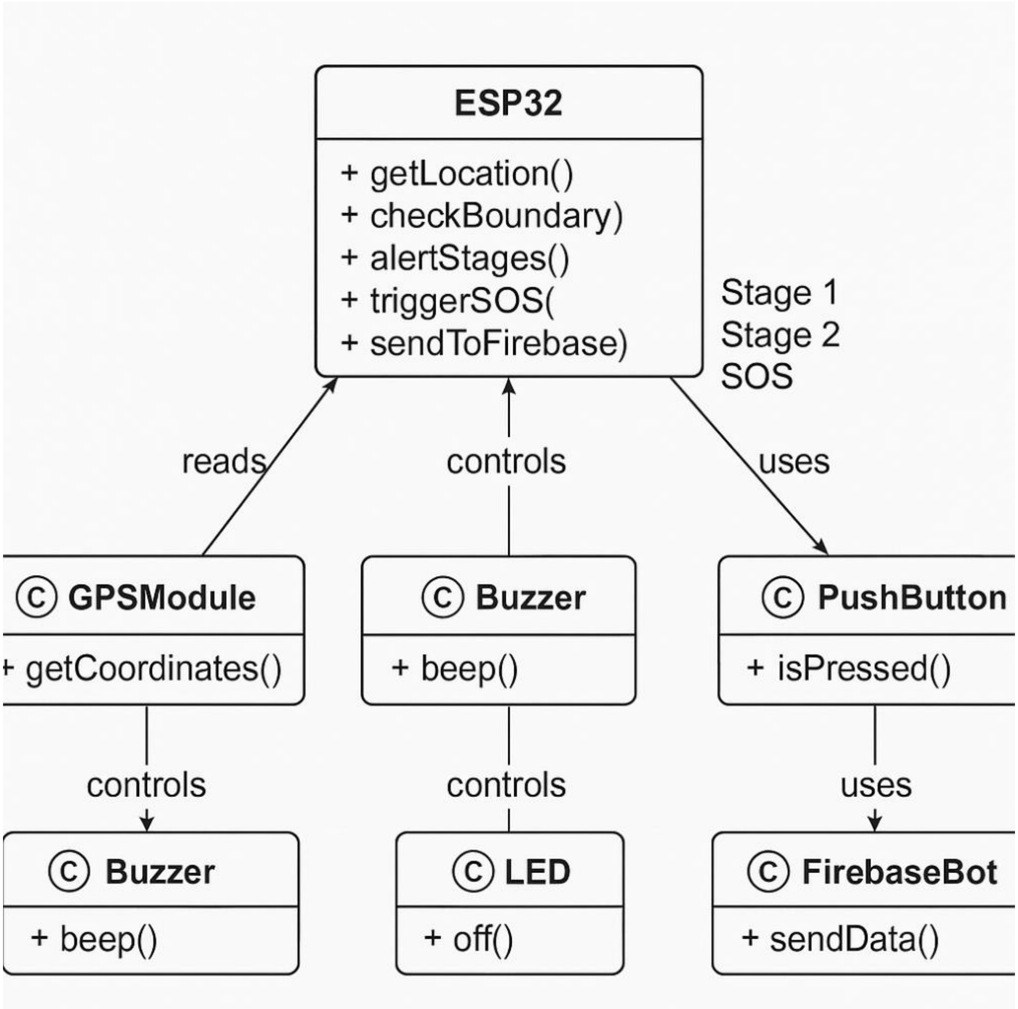


Figure 3.4 Class Diagram

The above Figure 3.4 is the class diagram for the system.

CHAPTER 4

MODULE DESCRIPTION

4.1 HARDWARE MODULE:

The IoT-Based Fisherman Border Alert System is designed to ensure the safety of fishermen operating near international maritime boundaries. At its core is the ESP32 microcontroller, which processes data from the GPS module to determine the vessel's real-time location. The GPS module provides latitude and longitude coordinates, enabling the system to compare the vessel's position against predefined boundary coordinates. When the vessel approaches these boundaries, the system activates visual and auditory alerts to warn the fishermen. Red and yellow LEDs serve as visual indicators, with the red LED signaling a critical proximity to the boundary and the yellow LED serving as a cautionary signal. An onboard buzzer emits an audible alarm when the vessel nears or crosses into a restricted area, providing immediate attention to the situation. Additionally, an SOS push button allows fishermen to manually trigger an emergency alert, notifying nearby authorities or coast guards of a distress situation. The entire system is powered by a 5V power supply, typically sourced from a portable USB battery pack, ensuring continuous operation during fishing activities. Optionally, an LCD or OLED display can be integrated to provide real-time information, such as the vessel's current coordinates, distance to the boundary, and system status. This hardware configuration enables the IoT-Based Fisherman Border Alert System to effectively monitor the vessel's location and provide timely alerts, thereby enhancing the safety of fishermen operating near international maritime boundaries.

4.2 DATA COLLECTION AND PROCESSING MODULE:

The Data Collection and Processing Module serves as the core component of the IoT-Based Fisherman Border Alert System, responsible for acquiring, processing, and interpreting location data to ensure maritime safety. At its heart is the ESP32 microcontroller, which interfaces with the GPS module to retrieve real-time positional information. The GPS module provides latitude and longitude coordinates, which the ESP32 processes to determine the vessel's proximity to predefined maritime boundaries. This data is then analyzed against set thresholds to assess the risk of entering restricted zones. If the vessel approaches these boundaries, the system activates visual and auditory alerts to warn the fishermen. Additionally, the ESP32 can communicate with external systems or cloud platforms to relay location data for further analysis or monitoring. This module ensures that the system accurately tracks the vessel's location and provides timely alerts, thereby enhancing the safety of fishermen operating near international maritime boundaries.

4.3 ALERTING MODULE:

- Yellow LED turns ON for first level alert (>50cm)
- Red LED for second level alert (20–50cm)
- Buzzer for final alert (<20cm)
- Button triggers SOS action when pressed

CHAPTER 5

SAMPLE CODING

Program

```
#include <TinyGPSPlus.h>
#include <WiFi.h>
#include <ESPAsyncWebServer.h>

#define RXD2 4
#define TXD2 2

TinyGPSPlus gps;
HardwareSerial neogps(1);

// LED & Buzzer Pins
#define GREEN_LED 21
#define YELLOW_LED 22
#define RED_LED 23
#define BUZZER 19
#define SOS_BUTTON 18

// Center point
double centerLat = 12.345678;
double centerLng = 76.543210;
float safeRadius = 2.0;
float cautionRadius = 4.0;
float dangerRadius = 6.0;

// WiFi credentials
const char* ssid = "Don't smuggle_2G";
const char* password = "azam1502";

AsyncWebServer server(80);
AsyncWebSocket ws("/ws");

bool sosTriggered = false;
unsigned long sosStartTime = 0;
String zoneStatus = "🟢 SAFE";
double currentLat = 0.0, currentLng = 0.0;

double distanceInMeters(double lat1, double lon1, double lat2, double lon2)
```

```
{
  double R = 6371000;
  double dLat = radians(lat2 - lat1);
  double dLon = radians(lon2 - lon1);
  double a = sin(dLat / 2) * sin(dLat / 2) +
             cos(radians(lat1)) * cos(radians(lat2)) *
             sin(dLon / 2) * sin(dLon / 2);
  double c = 2 * atan2(sqrt(a), sqrt(1 - a));
  return R * c;
}

void notifyClients() {
  String msg = zoneStatus + "|" + String(currentLat, 6) + "," +
String(currentLng, 6);
  ws.textAll(msg);
}

void handleSOS() {
  if (digitalRead(SOS_BUTTON) == LOW && !sosTriggered) {
    sosTriggered = true;
    sosStartTime = millis();
    zoneStatus = "🚨 SOS Triggered!";
    ws.textAll("SOS|10");  // Trigger SOS countdown in UI
  }
}

void setup() {
  Serial.begin(115200);
  neogps.begin(9600, SERIAL_8N1, RXD2, TXD2);

  pinMode(GREEN_LED, OUTPUT);
  pinMode(YELLOW_LED, OUTPUT);
  pinMode(RED_LED, OUTPUT);
  pinMode(BUZZER, OUTPUT);
  pinMode(SOS_BUTTON, INPUT_PULLUP);

  WiFi.begin(ssid, password);
  Serial.print("Connecting to WiFi");
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("\nWiFi connected!");
```

```
  Serial.print("IP Address: ");
  Serial.println(WiFi.localIP());

  ws.onEvent([](AsyncWebSocket *server, AsyncWebSocketClient *client,
               AwsEventType type, void *arg, uint8_t *data, size_t len) {
    if (type == WS_EVT_CONNECT) {
      Serial.println("WebSocket client connected");
      notifyClients();
    }
  });

  server.addHandler(&ws);

  server.on("/", HTTP_GET, [](AsyncWebServerRequest *request){
    request->send_P(200, "text/html", R"rawliteral(
<!DOCTYPE html>
<html>
<head>
  <title>FisherGuard SOS</title>
  <meta charset="UTF-8">
  <style>
    body {
      margin: 0; font-family: Arial, sans-serif; background: #111; color: white;
      text-align: center; padding: 20px; transition: background 1s ease;
    }
    #status {
      font-size: 2em; margin-top: 20px;
    }
    #location {
      font-size: 1.5em; margin-top: 10px; color: #0ff;
    }
    #sosOverlay {
      display: none;
      position: fixed; top: 0; left: 0; width: 100%; height: 100%;
      background: rgba(255, 0, 0, 0.8); color: white;
      z-index: 9999; text-align: center;
      animation: pulse 1s infinite alternate;
    }
    #countdown {
      font-size: 5em; margin-top: 30vh;
      animation: pop 0.4s ease;
    }
    @keyframes pop {
```

```
      0% { transform: scale(0.5); opacity: 0.5; }
      100% { transform: scale(1); opacity: 1; }
    }
    @keyframes pulse {
      from { background-color: rgba(255, 0, 0, 0.6); }
      to { background-color: rgba(255, 0, 0, 1); }
    }
  </style>
</head>
<body>
  <h1>🌊 FisherGuard Monitor</h1>
  <div id="status">Loading...</div>
  <div id="location">Locating...</div>

  <div id="sosOverlay">
    <div id="countdown">10</div>
    <div style="font-size: 2em;">🚨 SOS Activated!</div>
  </div>

  <script>
    const statusDiv = document.getElementById("status");
    const locationDiv = document.getElementById("location");
    const sosOverlay = document.getElementById("sosOverlay");
    const countdown = document.getElementById("countdown");
    let ws = new WebSocket("ws://" + location.host + "/ws");

    let interval;
    ws.onmessage = (event) => {
      const [status, gps] = event.data.split("|");

      if (status === "SOS") {
        let count = parseInt(gps);
        sosOverlay.style.display = "block";
        countdown.innerText = count;
        clearInterval(interval);
        interval = setInterval(() => {
          count--;
          if (count >= 0) {
            countdown.innerText = count;
            countdown.style.animation = 'none';
            countdown.offsetHeight;
            countdown.style.animation = 'pop 0.4s ease';
          } else {
```

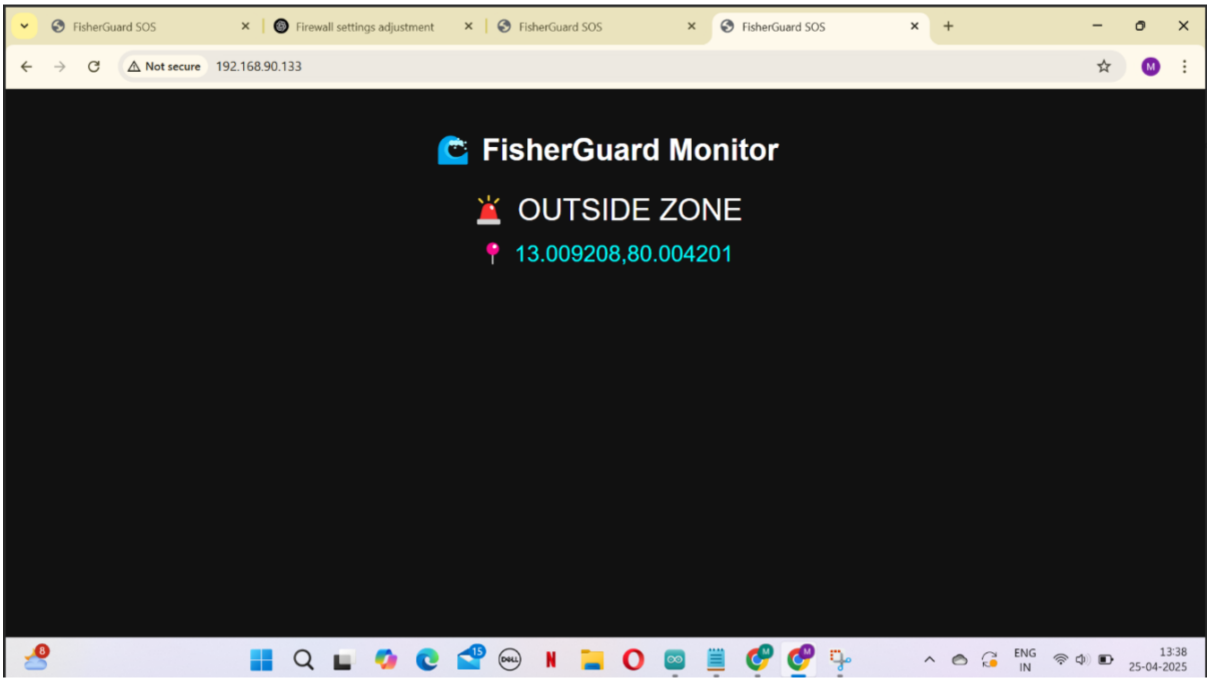
```
          clearInterval(interval);
          sosOverlay.style.display = "none";
          document.body.style.background = "#111";
        }
      }, 1000);
    } else {
      statusDiv.innerText = status;
      locationDiv.innerText = "📍 " + gps;
    }
  };
  </script>
</body>
</html>
    )rawliteral");
  });

  server.begin();
}

void loop() {
  while (neogps.available()) {
    gps.encode(neogps.read());

    if (gps.location.isUpdated()) {
      currentLat = gps.location.lat();
      currentLng = gps.location.lng();

      double dist = distanceInMeters(currentLat, currentLng, centerLat,
centerLng);
      Serial.printf("Lat: %.6f | Lng: %.6f | Dist: %.2f m\n", currentLat,
currentLng, dist);

      if (!sosTriggered) {
        if (dist < safeRadius) {
          digitalWrite(GREEN_LED, HIGH);
          digitalWrite(YELLOW_LED, LOW);
          digitalWrite(RED_LED, LOW);
          digitalWrite(BUZZER, LOW);
          zoneStatus = "🟢 SAFE";
        } else if (dist < cautionRadius) {
          digitalWrite(GREEN_LED, LOW);
          digitalWrite(YELLOW_LED, HIGH);
          digitalWrite(RED_LED, LOW);
```

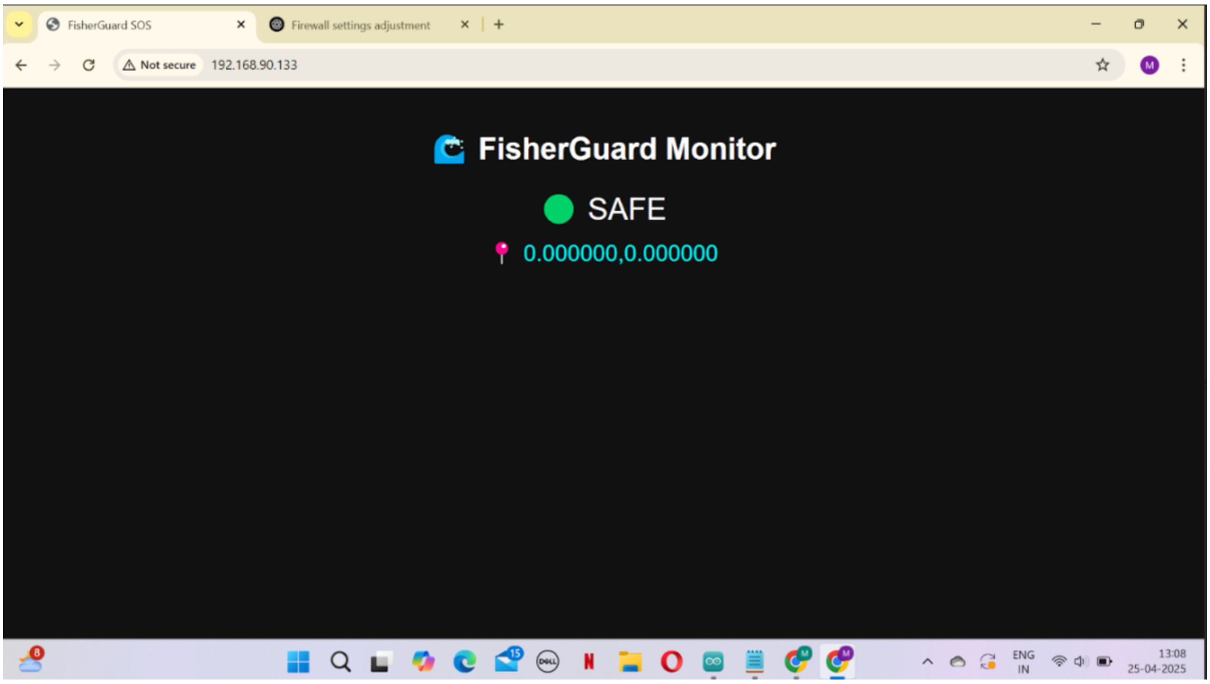
```
        digitalWrite(BUZZER, LOW);
        zoneStatus = "🟡 CAUTION";
      } else if (dist < dangerRadius) {
        digitalWrite(GREEN_LED, LOW);
        digitalWrite(YELLOW_LED, LOW);
        digitalWrite(RED_LED, HIGH);
        digitalWrite(BUZZER, HIGH);
        zoneStatus = "🔴 DANGER ZONE";
      } else {
        digitalWrite(GREEN_LED, LOW);
        digitalWrite(YELLOW_LED, LOW);
        digitalWrite(RED_LED, HIGH);
        digitalWrite(BUZZER, HIGH);
        zoneStatus = "🚨 OUTSIDE ZONE";
      }

      notifyClients();
    }
  }
}

// Reset SOS after 10 seconds
if (sosTriggered && millis() - sosStartTime >= 10000) {
  sosTriggered = false;
  zoneStatus = "🟢 SAFE";
  notifyClients();
}

handleSOS();
}
```

CHAPTER 6

SCREEN SHOTS

1. Data Sent from ESP32 to Telegram Bot





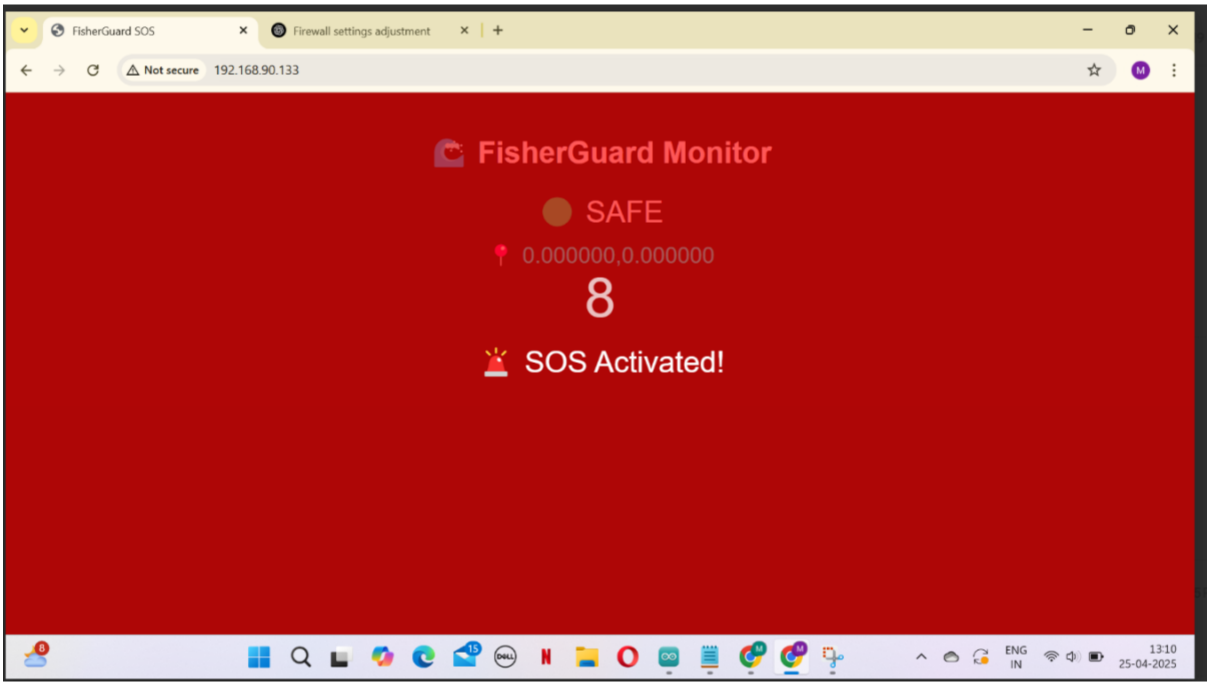


Figure 6.1 Data Received by Telegram bot from ESP32

CHAPTER 7

CONCLUSION AND FUTURE ENHANCEMENT

The IoT-Based Fisherman Border Alert System effectively addresses the critical issue of fishermen inadvertently crossing international maritime boundaries, a problem that has led to legal consequences and loss of livelihoods. By integrating GPS technology with real-time location tracking, the system provides timely alerts through visual indicators and audible alarms, ensuring fishermen remain within national waters. This proactive approach not only safeguards the lives of fishermen but also fosters positive relations between neighboring countries by reducing border-related incidents. The system's affordability and ease of use make it accessible to fishermen, even in remote coastal areas, thereby contributing to their safety and well-being.

Integrating voice alerts into the IoT-Based Fisherman Border Alert System can significantly enhance user experience by providing clear, audible warnings in addition to visual indicators. Utilizing Text-to-Speech (TTS) modules, such as the WT5001M02-28P or JQ6500, allows the system to audibly announce proximity alerts like "Warning: Approaching restricted area," ensuring that fishermen receive immediate attention, even in noisy environments. This enhancement is particularly beneficial in maritime settings where visual cues may be overlooked due to glare or distractions. By incorporating voice alerts, the system becomes more accessible and responsive, improving overall safety and user engagement.

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